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EXAMINER	
BAIG, ADNAN	
ART UNIT	PAPER NUMBER
4172	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/597,735	MALTSEV ET AL.	
	Examiner	Art Unit	
	ADNAN BAIG	4172	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *August 4, 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-21* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-3 and 6-21* is/are rejected.

7)☒ Claim(s) *4 and 5* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *04 August 2006* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *8/4/2006*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 101

1. 35 U.S.C. 101 reads as follows:

Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

Claims 15-19 are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter. The subject matter claimed, in accordance with applicants specification is a computer program with instructions that is not executable because it has to be compiled and installed which is a non tangible medium. [0087] Lines (18-21).

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claim 1 is rejected under 35 U.S.C. 102(b) as being anticipated by Serfaty (US 5,293,401)

Regarding Claim 1, Serfaty discloses a method to perform channel estimation comprising:

A method to perform channel estimation, comprising:

receiving a first training sequence;

estimating a maximum likelihood estimate of a channel impulse response using said first received training sequence; Col. 1 Lines (50-58)

Referring to Fig. 3, the first training sequence is received at Item 20. At the bottom of the figure maximum likelihood estimation is illustrated with Items 25 and 26.

The Viterbi Equalizer mentioned Col. 2 (Lines 8-9), or slicer, refers to the maximum likelihood estimate. Refer to Fig. 3 Item 25.

receiving a second training sequence; and

estimating at least one channel impulse response estimate using said maximum likelihood estimate and said second received training sequence. Col. 1 Lines (59-62)

Regarding Claim 2, Serfaty discloses the method of claim 1, wherein estimating said maximum likelihood estimate comprises:

filtering said first received training sequence using a filter matched to said first received training sequence to form a first set of vectors for a matrix;

Col. 2 (Lines 3-14) the detected symbols refer to the training sequence. Refer to Fig. 3 Item 20.

and transforming said matrix to form said maximum likelihood estimate.
A matrix is formed at the feedback equalizer once coefficients are determined from the estimated impulse response. Col. 4 (Lines 35-45) See Fig. 3 Item 26 Referring to Fig.3, the output of Item 26 which contains the matrix is sent to Item 25, where the maximum likelihood estimate is formed.

Regarding Claim 3, Serfaty discloses the method of claim 1, wherein estimating said channel impulse response estimate comprises:

receiving said maximum likelihood estimate; Col. 4 Lines(7-8, 11-16) Referring to Fig.3 Item 25, The slicer as mentioned in claim 1 sends the maximum likelihood output into the input of Item 26, the Decision Feedback Equalizer, which contains the coefficients of the estimated impulse response of the channel.

generating a set of threshold values using said maximum likelihood estimate; Col. 6 Line 45.
The output of the decision feedback equalizer contains the maximum likelihood as mentioned above and a set of predetermined threshold values are generated.

generating a set of candidate channel impulse response estimate vectors using said threshold values; Col. 4 Lines (40-45) the coefficients of the impulse response located in Item 26 Fig. 3 are determined by the vectors in Eq.4.

and selecting said channel impulse response estimate from said candidate channel impulse response estimate vectors. Col.4 Lines (40-45). Selecting or determining the impulse response from the vector estimates is shown.

Regarding Claim 6, Serfaty discloses the method of claim 3, wherein said selecting comprises:

filtering said first received training sequence using said candidate channel impulse response estimate vectors to form a second set of vectors;

Col. 3 Lines (55-60), Training sequence is filtered.

Col. 4 Lines (45-50). Impulse response is selected or given.

Referring to Fig. 3 Item 26, the decision feedback equalizer filters the impulse response estimate vectors which contain the first training sequence.

A second set of channel impulse response vectors will be generated and the process will repeat since a second training sequence is received in the channel.

Col. 1 Lines (59-62)

determining a set of distance values between said second set of vectors and said second received training sequence; Col. 2 (lines 18-25) The coefficients or values, are determined where frames refer to the coefficients of each set of vectors and a second frame is introduced.
Col. 5 Lines (65-68). "N" refers to the length or distance in frames.

selecting a minimum distance value from said set of distance values; and selecting said channel impulse response estimate vector using said minimum distance value. Col.2 Lines (25-38). The midpoint or minimum distance is used in the frame for quality purposes and the channel impulse response is selected within the frame as shown in Col.4 Lines (40-45).

Regarding Claim 8, Serfaty discloses a system comprising:
a maximum likelihood estimator to generate a maximum likelihood estimate using a first received training sequence;
The Viterbi Equalizer mentioned Col. 2 (Lines 8-9), or slicer, refers to the maximum likelihood estimator. Refer to Fig. 3 Item 25.
See Col. 1 Lines (43-50) with regards to maximum likelihood estimate of first training sequence.

and a channel tap estimator to couple to said maximum likelihood estimator, said

channel tap estimator to receive said maximum likelihood estimate and a second received training sequence, Col. 4 (Lines 4-8)

Referring to Figure 3, The channel Taps C(1) and C(2) are shown in Item 26, decision feedback equalizer 26 where it takes the output of Item 25 as its input. Item 26 receives a second training sequence as mention in Col. 1 (Lines 50-59).

said channel tap estimator to generate at least one channel impulse response estimate using said maximum likelihood estimate and said second received training sequence. Col. 1 (Lines 50-59), the channel impulse response estimate is generated by item 26 Fig. 3, Col. 4 Lines (13-16)

Referring to Fig.3, the Channel Tap estimator uses said maximum likelihood where Item 26 takes the output of Item 25.

Regarding Claim 9, Serfaty discloses a system of claim 8, wherein said maximum likelihood

estimator comprises:

a filter to receive said first received training sequence, said filter to filter said first received training sequence to form a first set of vectors for a matrix; Col. 2 (Lines 8-14).

and a matrix transformer to transform said matrix to form said maximum likelihood estimate.

Col. 4 (Lines 35-45) See Fig. 3 Item 26

Referring to Fig.3, the output of Item 26 which contains the matrix is sent to Item 25, where the maximum likelihood estimate is formed.

Regarding Claim 10, Serfaty discloses the system of claim 8, wherein said channel tap estimator comprises:

a threshold generator to receive said maximum likelihood estimate and generate a set of threshold values using said maximum likelihood estimate; Col. 6 Line 45 Referring to Fig. 3, Chanel taps C(1) and C(2) receive the output of Item 25 which contains the maximum likelihood estimate.

a candidate channel impulse response generator to receive said threshold values, and to generate a set of candidate channel impulse response estimate vectors using said threshold values; Col. 4 Lines (13-16). Referring to Item 26 in Fig. 3, the decision feedback equalizer generates the channel impulse response vectors as shown in Col. 4 Lines (40-45) or claim 3.

and a channel impulse response selector to receive said candidate channel impulse response estimate vectors and a minimum distance value Col.2 Lines (25-38) The midpoint or minimum distance is used in the frame for quality

purposes and the channel impulse response is selected within the frame as shown in Col.4 Lines (40-45).

said channel impulse response selector to use said candidate channel impulse response estimate vectors and said minimum distance value to select said channel impulse response estimate.
Col. 2 Lines (3-5). The coefficients mentioned are used in the frame to determine or select the Channel impulse response done by Item 26, Fig. 3. See Col. 4 Lines (10-16).

Regarding Claim 11, Serfaty discloses the system of claim 8, further comprising:
a filter to receive said first received training sequence and said candidate channel
impulse response estimate vectors, (Col. 2 Lines 8-14) Referring to Fig. 3 Item 26, the decision feedback equalizer contains a feedback FIR filter as mentions which receives the first training sequence and channel impulse response vectors.

said filter to filter said first received training sequence using said candidate channel impulse response estimate vectors to form a second set of vectors; A second set of channel impulse response vectors will be generated and the process will repeat since a second training sequence
is received in the channel. Col. 1 Lines (59-62)

a distance calculator to receive a second training sequence and said second set of vectors, said distance calculator to determine a set of distance values between said second set of vectors and said second received training sequence; Col. 2 (lines 18-25) The coefficients or values, are determined where frames refer to the coefficients of each set of vectors and a second frame is introduced. Col. 5 Lines (65-68). "N" refers to the length or distance in frames.

and a minimum selector to receive said distance values and select a minimum distance value from said set of distance values, and output said minimum distance value to said channel impulse response selector.
Col.2 Lines (25-38). The midpoint or minimum distance is used in the frame for quality purposes and the channel impulse response is selected within the frame as shown in Col.4 Lines (40-45).

Regarding Claim 15, Serfaty discloses an article comprising a storage medium; said storage medium including stored instructions that, when executed by a processor, result in performing channel estimation by receiving a first training sequence,
estimating a maximum likelihood estimate of a channel impulse response using said first received training sequence, Col. 1 Lines (50-58)

Referring to Fig. 3, the first training sequence is received at Item 20. At the bottom of the figure maximum likelihood estimation is illustrated with Items 25 and 26.

The Viterbi Equalizer mentioned Col. 2 (Lines 8-9), or slicer, refers to the maximum likelihood estimate. Refer to Fig. 3 Item 25.

receiving a second training sequence, and estimating at least one channel impulse response estimate using said maximum likelihood estimate and said second received training sequence. Col. 1 Lines (59-62)

Regarding Claim 16, Serfaty discloses the article of Claim 15, wherein the stored instructions, when executed by a processor, further result in estimating said maximum likelihood estimate by filtering said first received training sequence using a filter matched to said first received training sequence to form a first set of vectors for a matrix, Col. 2 (Lines 3-14) The detected symbols refer to the training sequence. Refer to Fig. 3 Item 20.

and transforming said matrix to form said maximum likelihood estimate.

A matrix is formed at the feedback equalizer once coefficients are determined from the estimated impulse response. Col. 4 (Lines 35-45) See Fig. 3 Item 26 Referring to Fig.3, the output of Item 26 which contains the matrix is sent to Item 25, where the maximum likelihood estimate is formed.

Regarding Claim 17, Serfaty discloses the article of claim 15, wherein the stored instructions, when executed by a processor, further result in estimating said channel impulse response estimate by receiving said maximum likelihood estimate

Col. 4 Lines(7-8, 11-16) Referring to Fig.3 Item 25, The slicer as mentioned in claim 1 sends the maximum likelihood output into the input of Item 26, the Decision Feedback Equalizer, which contains the coefficients of the estimated impulse response of the channel.

generating a set of threshold values using said maximum likelihood estimate Col. 6 Line 45. The output of the decision feedback equalizer contains the maximum likelihood as mentioned above and a set of predetermined threshold values are generated.

generating a set of candidate channel impulse response estimate vectors using said threshold values, Col. 4 Lines (40-45) The coefficients of the impulse response located in Item 26 Fig. 3 are determined by the vectors in Eq.4.

and selecting said channel impulse response estimate from said candidate channel impulse response estimate vectors. Col.4 Lines (40-45). Selecting or determining the impulse response from the vector estimates is shown.

Regarding Claim 18, Serfaty discloses the article of claim 17, wherein the stored instructions, when executed by a processor, further result in said selecting by

filtering said first received training sequence using said candidate channel impulse response estimate vectors to form a second set of vectors,
Col. 3 Lines (55-60), Col. 4 Lines (45-50).
Referring to Fig. 3 Item 26, the decision feedback equalizer filters the impulse response estimate vectors which contain the first training sequence. Col. 3 Lines (55-60), Col. 4 Lines (45-50).

A second set of channel impulse response vectors will be generated and the process will repeat since a second training sequence is received in the channel. Col. 1 Lines (59-62)

determining a set of distance values between said second set of vectors and said second received training sequence, Col. 2 (lines 18-25) The coefficients or values, are determined where frames refer to the coefficients of each set of vectors and a second frame is introduced. Col. 5 Lines (65-68). "N" refers to the

length or distance in frames.

selecting a minimum distance value from said set of distance values, and selecting said channel impulse response estimate vector using said minimum distance value. Col.2 Lines (25-38). The midpoint or minimum distance is used in the frame for quality purposes and the channel impulse response is selected within the frame as shown in Col.4 Lines (40-45).

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 7, 12, 14 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Serfaty (US 5,293,401) in view of Ketchum (US 2003/0185310).

Regarding Claim 7, Serfaty discloses the method of claim 1, comprising: receiving said channel impulse response estimate at a crosstalk filtering module to form a channel impulse response matrix; creating a crosstalk suppression filter matrix based on said channel impulse response matrix; and filtering a plurality of data streams received over a channel as shown at the bottom portion of Fig. 3,

but does not expressly disclose the application in a MIMO communication channel. Ketchum discloses a method of estimating a channel impulse response matrix, ([0081] [0080] Lines 1-5) implementing a crosstalk suppression filter, ([0007] Lines 3-11) and filtering a plurality of data streams in a MIMO communication channel. ([0007] Lines 1-3, Lines 13-18). Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to perform channel estimation and equalize an impulse response matrix in a MIMO communication system to reduce noise interference or crosstalk.

Regarding Claim 12, Serfaty discloses the system of Claim 8, but does no expressly dislose a communications medium comprising, a plurality of transmitters to connect to said communications medium, with each transmitter to transmit a data stream over said communications medium using a communications channel;
a plurality of receivers to connect to said communications medium, said plurality of receivers to receive said data streams from said communications channel; and a crosstalk filtering module to connect to said plurality of receivers, said crosstalk filtering module to receive said channel impulse response estimate and use said channel impulse response estimate to filter said data streams to reduce crosstalk signals incurred by said data streams during said transmission. Ketchum discloses a MIMO communications channel as mentioned above in Figures 1 and 3. Referring to Fig. 3, Items 322a and 322t contain a plurality of receivers where

data streams are received. [0019 Lines 7-8]. Ketchum clearly shows a crosstalk filtering module filtering the data streams of an estimated channel impulse response. ([0007] Lines 1-3, Lines 13-18). Therefore it would have been obvious to one of ordinary skill in the art to use the concept of maximum likelihood estimation for estimating the channel impulse response in a MIMO communication system for eliminating interference or crosstalk.

Regarding Claim 14, the combination of Serfaty and Ketchum teach the system of claim 12, wherein said crosstalk filtering module comprises: a channel impulse response matrix generator to generate a channel impulse response matrix; (Ketchum, [0081] [0080] Lines 1-5)
a crosstalk suppression filter matrix generator to generate a crosstalk suppression filter matrix using said channel impulse response matrix; and (Ketchum, [0007] Lines 3-11)
a filter to filter said data streams using said crosstalk suppression filter matrix. (Ketchum, [0007] Lines 1-3, Lines 13-22)
Referring to Fig.1 (Ketchum), Section 170 filters data streams which are which are received from the MIMO channel.

Regarding Claim 19, Serfaty discloses the article of claim 15, comprising: receiving said channel impulse response estimate at a crosstalk filtering module to form a channel impulse response matrix; creating a crosstalk suppression filter

matrix based on said channel impulse response matrix; and filtering a plurality of data streams received over a channel as shown at the bottom portion of Fig. 3, but does not expressly disclose the application in a MIMO communication channel. Ketchum discloses a method of estimating a channel impulse response matrix, ([0081] [0080] Lines 1-5) implementing a crosstalk suppression filter, ([0007] Lines 3-11) and filtering a plurality of data streams in a MIMO communication channel. ([0007] Lines 1-3, Lines 13-18). Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to perform channel estimation and equalize an impulse response matrix in a MIMO communication to reduce noise interference or crosstalk.

5. Claim13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Serfaty (US 5,293,401) in view of Ketchum (US 2003/0185310), Further in view of Erickson (US 6,978,015).

Regarding Claim 13, the combination of Serfaty and Ketchum disclose the system of claim 12, but do not expressly disclose a plurality of equalizers to connect to said filtering module, said equalizers to equalize said filtered data streams using a set of substantially similar equalization parameters. Erickson discloses a communications network wherein multiple equalizers are implemented in Fig.4 for cross talk compensation. (Col. 10 Lines 45-57). Therefore it would have been obvious to one of ordinary skill in the art to use a

plurality of equalizers in a multiple input multiple output system to filter distortion from the data streams for reducing crosstalk noise.

6. Claims 20-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Serfaty (US 5,293,401) in view of Ghosh (US 2006/0114981).

Regarding claim 20, Serfaty discloses the method of claim 1, further comprising estimating a second maximum likelihood estimate of a channel impulse response using said second received training sequence; estimating a second channel impulse response estimate using said second maximum likelihood estimate and said first received training sequence, Col. 1 (Lines 50-59) Fig. 1, Item 25, but does not expressly disclose averaging said channel impulse response estimates to find an averaged channel impulse response estimate. Ghosh discloses a method of averaging the channel estimates or channel impulse response estimates in communication channel [0065-0066]. Therefore it would have been obvious to one of ordinary skill in the art to average the channel impulse response estimate for each training sequence so the channel is less sensitive to interference or crosstalk as Ghosh mentions.[0080] (Lines 1-6).

Regarding claim 21, Serfaty discloses the method according to claim 1, further comprising receiving an i-th training sequence; Col. 1 Lines 50-53, Serfaty clearly shows that multiple sequences are transmitted in the channel.

Estimating an M channel impulse response estimate using said i-th training sequence Col.4 Lines (40-45), but does not expressly disclose averaging the said M channel impulse response to find an averaged channel impulse response. Ghosh discloses a method of averaging the channel estimates or channel impulse response estimates to find an averaged channel impulse response estimate [0065-0066]. Therefore it would have been obvious to one of ordinary skill in the art to average the channel impulse response estimate for each training sequence so the channel is less sensitive to interference or crosstalk as Ghosh mentions.[0080] (Lines 1-6).

Allowable Subject Matter

7. Claims 4-5 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to ADNAN BAIG whose telephone number is (571) 270-7511. The examiner can normally be reached on Mon-Fri 7:30m-5:00pm eastern every other Fri off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Lewis West can be reached on 571-272-7859. The fax phone

number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/ADNAN BAIG/
Examiner, Art Unit 4172

/Lewis G. West/

Supervisory Patent Examiner, Art Unit 4172